1. INTRODUCTION

The California Air Resources Board (ARB), San Diego County Air Pollution Control District (SDAPCD), South Coast Air Quality Management District (SCAQMD), Ventura County Air Pollution Control District (VCAPCD), U. S. Environmental Protection Agency (EPA) - Region IX, and the U. S. Navy are planning the 1997 Southern California Ozone Study (SCOS97) as part of the North American Research Strategy for Tropospheric Ozone (NARSTO). The goals of the study are to update and improve the existing aerometric and emission databases and model applications for representing urban-scale ozone episodes in southern California, and to quantify the contributions of ozone generated from emissions in one southern California air basin to federal and state ozone standard exceedances in neighboring air basins. The SCOS97-NARSTO Field Study Plan (Fujita et al., 1996) provides a conceptual model for the ozone episodes and transport scenarios of interest and specifies the data requirements for data analysis and modeling. It also describes the required quality assurance (QA), data validation, and data management needs. This document specifies the QA activities that will be performed during SCOS97-NARSTO.

The purpose of quality assurance is to provide a quantitative estimate of the uncertainty of the measurements through estimates of the precision, accuracy (or bias), and validity. In addition, QA ensures that the procedures and sampling methods used in the study are well documented and are capable of producing the data which meet the specifications of the study. The QA auditing program consists of two components: system audits and performance audits. System audits include review of operational and quality control procedures to assess whether they are adequate to assure valid data which meet the specified levels of accuracy and precision. After reviewing the procedures, the auditor examines all phases of the measurement or data processing activity to determine whether the procedures are being followed and the operating personnel are properly trained. Performance audits establish whether the predetermined specifications for accuracy are being achieved in practice. For measurements, the performance audit involves challenging the measurement/analysis system with a known standard sample that is traceable to a primary standard. Measurements that can be subject to sampling artifacts, such as carbonyl compounds, hydrocarbon speciation, and NOy, preclude simple performance audits. Intercomparison studies are often used in these cases to assess the representativeness, accuracy, and precision of these measurements.

Quality assurance is closely connected with data management. Before sampling starts, the QA team assists the investigators and the data management contractor to develop the format of the database; the QA team also reviews the investigators' standard operating procedures (SOPs) and makes estimates of the precision and accuracy that might be expected from the measurement systems. Prior to or during sampling the QA team carries out systems and performance audits and helps resolve any problems. Once the sampling has been completed and the investigators have provided the data management contractor with level 1A-validated (verified, screened, adjusted and flagged) data sets, the QA team helps validate the data in two stages, level 1B (univariate checks such as maxima and minima, rates of change and diurnal variations) and level 2 (multivariate consistency tests based on known physical, spatial or temporal relationships). Level 1B validation should be performed by the data manager with validation criteria determined by agreement between measurement investigators and the QA team. The QA team also makes the final estimates of the precision and accuracy of the data with the help of the investigators and the data manager.

This QA plan describes the procedures that will enable the QA Team to verify that planned quality control procedures are being followed and the measured data are meeting specified tolerances. The plan identifies the work elements to be performed, the technical approach for implementing each element, and the schedule for performing the work. It specifies the measured quantities to be challenged during the audits, criteria for evaluation of audit findings, estimated precision and accuracy of audit standards, certification of audit standards, and approaches to problem resolution and verification of corrections. Data quality objectives (see section 3) are specified prior to the study to ensure that all measured data meet the end-use requirements for air quality and meteorological model input and evaluation, data analyses, and monitoring the success of meeting data quality objectives. Precision and accuracy goals are identified for measurement variables. Many methods and procedures employed in SCOS97-NARSTO are routinely measured variables for which expected precision and accuracy are known. Other measurements are experimental and target objectives that can only be estimated.

Quality assurance will be under the overall direction of Desert Research Institute, the QA manager for SCOS97-NARSTO. DRI will coordinate a QA team consisting of staff from sponsoring agencies and other contractors that have the necessary expertise to carry out the QA activities in this plan. DRI and the QA team will review standard operating procedures, perform system and performance audits, review and validate study data processing procedures and data, and estimate the uncertainties in the data. The QA team will work closely with the data manager, the field manager, and investigators.

1.1 Goals and Technical Objectives of SCOS97-NARSTO

The goals of the SCOS97-NARSTO study are to :

1. Update and improve the existing aerometric and emission databases and model applications for representing urban-scale ozone episodes in southern California, with a primary emphasis on high ozone concentrations in the South Coast Air Basin and secondary emphasis on high ozone concentrations in the San Diego Air Basin, the South Central Coast Air Basin, and the Southeast Desert Air Basin.

2. Quantify the contributions of ozone generated from emissions in one southern California air basin to federal and state ozone standard exceedances in neighboring air basins. Evaluate the interaction of transported ozone and ozone precursors, both at the surface and aloft, with emissions in neighboring receptor areas. Apply modeling and data analysis methods to design regional ozone attainment strategies.

These goals are to be met through a process which includes analysis of existing data; execution of a large-scale field study to acquire a comprehensive database to support modeling and analysis; analysis of the data collected during the field study; and the development, evaluation, and application of an air quality simulation model for southern California.

Specific technical objectives of SCOS97-NARSTO are as follows:

1. Obtain a documented data set of specified precision, accuracy, and validity that supports modeling and data analysis efforts.

2. Document the frequency, intensity, and character of high ozone concentrations and its VOC and NO_X precursors within and between neighboring southern California air basins, and determine how these have changed over the past decade.

3. Identify and describe transport pathways between neighboring air basins, and estimate the fluxes of ozone and precursors transported at ground level and aloft under meteorological conditions associated with high ozone concentrations.

4. Quantify the uncertainty of emissions rates, chemical compositions, locations, and timing of ozone precursors that are estimated by emission models.

5. Quantify the uncertainty of meteorological models in simulating transport and mixing of precursors and end-products within and between air basins.

6. Quantify the uncertainty of air quality models in simulating atmospheric transformation and deposition.

7. Provide the meteorological and air quality measurements needed to estimate, with stated uncertainty intervals, the contributions from background, regional mixing and transport, and local emitters to ozone concentrations that exceed standards in each of the air basins.

8. Provide the meteorological and air quality measurements needed to estimate the effects of different emission reduction strategies on ozone concentrations within and beyond each air basin, and identify those that cause the greatest reduction in population exposure for the least cost.

1.2 Study Location

SCOS97 will encompass the South Coast (SoCAB), San Diego (SDAB), South Central Coast (SCCAB), and Southeast Desert (SEDAB) Air Basins extending to northern Mexico to the south and to Nevada and Arizona to the east. The northern boundary of this study will include the southern portion of the San Joaquin Valley Air Basin (SJVAB). The western boundary will be defined by the results of measurements which identify where clean air typically exists over the Pacific Ocean.

1.3 Study Area Climatology

Southern California is in the semi-permanent high pressure zone of the eastern Pacific. During summer, average temperatures are ~25 ^{o}C, with maximum daily readings often exceeding 35 ^{o}C. Precipitation events are rare. Frequent and persistent temperature inversions are caused by subsidence of descending air which warms when it is compressed over cool, moist marine air.

These inversions often occur during periods of maximum solar radiation which create daytime mixed layers of ~1,000 m thickness, though the top of this layer can be lower during extreme ozone episodes (Blumenthal *et al.*, 1978). Relative humidity depends on the origin of the air mass, proximity to the coast, altitude, and the time of day, and can exceed 50 percent during daytime throughout the SoCAB with the intrusion of a deep marine layer. Relative humidity is higher near the coast than farther inland (Smith *et al.*, 1984).

Smith *et al.* (1972), Keith and Selik (1977), and Hayes *et al.* (1984) describe wind flow patterns in the SoCAB. During summer, the sea-land breeze is strong during the day with a weak land-sea breeze at night. Owing to the high summer temperatures and extensive urbanization in the SoCAB, the land surface temperature does not usually fall below the water temperature at night, and nocturnal and morning winds are less vigorous than daytime winds. The land surface cools sufficiently to create surface inversions with depths as shallow as ~50 m. Surface heating usually erodes the surface and marine layers within a few hours after sunrise each day. Summertime flow patterns are from the west and south during the morning, switching to predominantly westerly winds by the afternoon. The land/sea breeze circulation moves air back and forth between the SoCAB and the Pacific Ocean, as well as along the coast to other air basins. Cass and Shair (1984) estimated that up to 50 percent of the sulfate measured at Lennox was due to emissions which had been transported to sea on the previous day. When wind speeds are low, air tends to slosh back and forth within the SoCAB.

In addition to these general features, there are many smaller features that affect the movement of pollutants within the SoCAB. Heating of the San Gabriel and San Bernardino Mountains during the daytime engenders upslope flows that can transport pollutants from the surface into the upper parts of, and sometimes above, the mixed layer. When the slopes cool after sunset, the denser air flows back into the SoCAB with pollutants entrained in it. Convergence zones occur where terrain and pressure gradients direct wind flow in opposite directions, resulting in an upwelling of air. Smith *et al.* (1984) have identified convergence zones at Elsinore (McElroy *et al.*, 1982; Smith and Edinger, 1984), the San Fernando Valley (Edinger and Helvey, 1961), El Mirage, the Coachella Valley, and Ventura. Rosenthal (1972) and Mass and Albright (1989) identified a Catalina Eddy, a counterclockwise mesoscale circulation within the Southern California Bight, as a mechanism for transporting air pollution. This eddy circulation transports pollutants from the SoCAB to Ventura, especially after the SoCAB ozone levels drop due to wind ventilation caused by an approaching low-pressure trough from the northwest. However, any southeast wind in southern California is initially capable of transporting polluted air consisting of ozone precursors and particulate matter from the SoCAB.

General meteorological conditions and trajectories during the 1987 SCAQS episodes have been examined by Douglas *et al.* (1991). Flows during the summertime were westerly, and residence times were often less than 12 hours. The backward trajectories from Claremont and Riverside on August 27 and 28, 1987 show an upper level recirculation in the middle of the SoCAB that probably led to the build-up of ozone and precursors during the episode. Trajectories during SCAQS episodes were consistent with stagnation conditions desired for selecting episodes, and they provide confidence that the SCAQS forecasting methods can be successfully adapted to SCOS97 to evaluate high ozone episodes in the SoCAB. Summer episodes showed west to east transport with potential for pollutant carryover aloft.

Green *et al.* (1992a) classified wind field patterns in the SoCAB, San Joaquin Valley, and Mojave Desert during 1984 and 1985 to evaluate visibility reduction in the desert. This analysis evaluated transport between the SoCAB and the Mojave and Arizona deserts. Winds were found to be directly related to the pressure field, which, in summer, resulted from a consistent mesoscale component added to a varying synoptic-scale component. Three main summer patterns were found, all of which had some transport into the SEDAB from the SoCAB. The first, and predominant, pattern indicated typical summer conditions with the wind field driven by the ocean/interior temperature difference and terrain features. The second pattern typically occurred in early summer (May-early June), and had stronger flow into the desert due to synoptic-scale pressure gradients (upper level low pressure over the west coast, surface low over the Intermountain region). This type was also less stable due to cold air aloft. The third pattern showed weaker flow into the desert (and flow from the SEDAB to the SoCAB for a few hours per day) due to higher pressure to the northeast.

The predominant surface wind climatologies for California have been compiled for ARB by Hayes *et al.* (1984) based on 1977-1981 wind data. Hayes *et al.* found seven types of wind flow patterns for the SoCAB and the surrounding air basins. During summer (June-August) and fall (September-November), calm, offshore, and downslope/transitional patterns dominate the early morning hours, allowing pollutants to accumulate in SoCAB industrial and business areas. Pollutants then move inland with the sea breeze in the afternoon hours. However, a period of southeast flow towards Ventura County can occur as the land breeze veers to a daytime sea breeze. While this diurnal sequence is most common during the ozone season, other combinations of wind patterns occur that drive interbasin transport. For example, off-shore surface transport from the SoCAB to San Diego may occur with the offshore winds, the downslope/transitional winds, and/or the weak Santa Ana.

1.4 Study Period and Intensive Operational Periods

The SCOS97 field measurement program will be conducted during a four-month period from June 15, 1997 to October 15, 1997. This study period corresponds to the majority of elevated ozone levels observed in southern California during previous years. Continuous surface and upper air meteorological and air quality measurements will be made hourly throughout this study period. Additional measurements will be made during intensive operational periods (IOPs) on a forecast basis for two to four consecutive days. Forecasts are prepared each day during the four-month period and IOP measurement groups are on standby. The budget for SCOS97-NARSTO allows for no more than 15 days total for the IOPs. With a minimum of two days per IOP, the maximum number of IOPs is seven. Five IOPs is more likely, with an average IOP duration of three days. The conceptual model for this study defines five categories of meteorological conditions, called scenarios, which are associated with ozone episodes and ozone transport in southern California. Intensive measurements will be made during these scenarios. The five scenarios in order of priority as specified by the SCOS97-NARSTO Technical Committee, and the periods of highest probability of their occurrence are as follows:

1. SoCAB Ozone Maximum (Type 1 IOP in late July to end of August). SoCAB pollutants remain trapped within SoCAB. There may be “local” exceedance days for other basins.

This condition may be accompanied by a "coast hugger," a near-coast flow of SoCAB pollutants toward the southeast.

2. Upper- Level Transport to San Diego (Type 2 IOP in late July to end of August). Ozone in a layer 300-500 m MSL above the marine layer or above the nocturnal inversion jets southeast toward San Diego. The centerline and width of this pathway are uncertain, and may range from the Interstate 15 route (east) to an off-shore route (west).

3. Secondary SoCAB Ozone Maximum (Type 3 IOP in late July to end of August). An on-shore breeze causes inland transport, with likely transport into the Mojave Desert. This situation may also correspond to local exceedances for Ventura, Santa Barbara, and San Diego Counties.

4. Eddy Transport to Ventura after SoCAB Maximum (Type 4 IOP in june). This is an extended SoCAB episode that ends with a southeast wind offshore, over the basin, and even sometimes in the desert. It is possibly an extension of Scenario #1 or #2. The ozone peaks are often seen at Newhall or Simi Valley on these days.

5. Off-Shore Surface Transport Direct to San Diego Air Basin (Type 5 IOP in September to October). This event is characterized by a mild Santa Ana wind condition followed by the on-shore flow. It occurs with greatest frequency later in the ozone season

These five scenarios comprise the core of a "conceptual model" of the ozone episodes and transport scenarios on interest, which serves as the basis for the experimental design of SCOS97-NARSTO. In practice, there may be overlap between the scenarios. For example, also related to the Santa Ana winds discussed in Scenario #5 are subsequent periods of southeast flow which cause transport to the South Central Coast Air Basin as discussed in Scenario #4. Mild Santa Ana winds may be associated with simultaneous transport from southern portions of SoCAB to SDAB and from northern portions of the SoCAB to the SCCAB.

1.5 Forecast and Decision Protocol

The decision to declare an IOP will be based on daily meteorological and air quality forecasts provided by a forecast team consisting of meteorologist from the California Air Resources Board, local air quality districts, and U.S. Navy. These forecasts and other information on current conditions and operational status will be used by the SCOS97-NARTO Management Team to decide whether intensive sampling would be performed the next day.

Under the current budget, there are probably sufficient resources for only one IOP for each type. The abort procedure formulated by the forecast team will be implemented to terminate an IOP if meteorological conditions do not follow expectations. While it is preferable to have all measurement systems operational for each IOP, and every attempt will be made to assure their operability, the program has been designed to allow an IOP to proceed even if some equipment is inoperable. A critical level of operability needs to be defined, however, beyond which an IOP would not acquire enough data to be useful. Maintenance and re-supply between IOPs needs to be considered as well. Depending on the number of consecutive total IOP days just completed and the number of aircraft used, the aircraft equipment operators need one or two days without sampling before starting another IOP. In addition, routine maintenance, which is a function of flight hours, is required.

1.6 SCOS97-NARSTO Measurements

Continuous surface-based measurements will be made daily throughout the study period, which begins June 15, 1997 and end on October 15, 1997. The study period monitoring network consists of existing surface air quality, surface meteorology, and upper-air meteorology monitoring sites, as well as new sites added specifically for this study. The continuous data are used to:

- Characterize or describe the spatial and temporal distribution of pollutant concentrations and meteorological parameters on days leading up to and during ozone episodes and for documenting the frequency of occurrence of different measures for comparison with prior and later years.
- Document the transport of pollutants and precursors between major source regions and non-attainment receptor areas, between the major source regions, and between offshore and onshore, during both episode and non-episode conditions.
- Provide initial and boundary conditions for air quality model initialization, and input data for data assimilation by prognostic meteorological models.
- Provide data within the modeling domain to evaluate the output of the models and to diagnose deviations of model assumptions from reality.

1.6.1 Existing Surface Air Quality and Meteorological Monitoring Sites

Currently operating ozone and NO_X monitoring sites are identified with respect to location, name, and associated measurements in Appendix A. All of these sites are operated by state and local air quality districts, are subject to quality assurance programs, and report their measurements into a common database. This network is adequate to characterize O_3 and NO_X at receptor sites in the study region. Photochemical Assessment Monitoring Stations (PAMS) hydrocarbon and carbonyl compound sampling will be conducted at 13 sites from July 1, 1997 to September 30, 1997, according to the schedule shown in Table 1-1. Additionally, PAMS VOC monitoring will be needed during IOPs that occur in June and October 1997. Ozone information is also provided by the U.S. Naval Air Warfare Center which operates ozone analyzers at Point Mugu and on nearby Laguna Peak to document correlations between ozone and wind direction.

Many of the air quality monitoring sites also measure wind and temperature. In addition to those air quality sites which measure meteorology, there is an extensive network of existing surface meteorological sites spread throughout the study area, including offshore locations on islands, oil platforms and instrumented environmental buoys. These sites generally provide continuous measurement of wind speed and direction with an averaging time of one hour or less. They are operated by military and civilian airports, air quality districts, the National

Weather Service, and others. Appendix B lists these surface meteorological monitoring sites. As planning progresses, it is likely that additional meteorological monitoring networks will be

Table 1-1
VOC Measurements at Photochemical Assessment Monitoring Stations (PAMS) in Southern California

Site Location	Type of Site	Year Deployed	VOC Method	Carbonyl Method	Frequency of VOC Measurements		Frequency of Carbonyl Measurements	
					EPA Rule	CA Alternative Plan	EPA Rule	CA Alternative Plan
Ventura County								
El Rio	2	1994	Canister/GC-FID	DNPH/HPLC	B	E, F	D	E
Simi Valley	3	1995	Canister/GC-FID		A or C	E, F		
Ventura - Emma Wood State Beach	1	1996	Canister/GC-FID		A or C	E, F		
South Coast Air Basin								
Pico Rivera	2	1994	Auto-GC	DNPH/HPLC	B	E, F	D	E
Upland	4	1994	Canister/GC-FID		A or C	E, F		
Azusa	3	1995	Canister/GC-FID		A or C	E, F		
Hawthorne	1	1996	Canister/GC-FID		A or C	E, F		
Burbank	2	1997?	Auto-GC?	DNPH/HPLC	B	E, F	D	E
Southeast Desert Air Basin								
Upland	1	1994	Canister/GC-FID		A or C	E, F		
Banning	2	1995	Canister/GC-FID	DNPH/HPLC	A or C	E, F	D	E
Burbank	1	1997?	Auto-GC?		A or C	E, F		
San Diego Air Basin								
El Cajon	2	1994	Canister/GC-FID	DNPH/HPLC	B	E, F	D	E
Alpine	3	1995	Canister/GC-FID		A or C	E, F		
Camp - Del Mar	1	1996	Canister/GC-FID		A or C	E, F		
San Diego - Overland	2	1994	Canister/GC-FID	DNPH/HPLC	B	E, F	D	E

Type 1 - Upwind background.
Type 2 - Maximum precursor emissions (typically located immediately downwind of the central business district).
Type 3 - Maximum ozone concentration.
Type 4 - Extreme downwind transported ozone area that may contribute to overwhelming transport in other areas.
A. Eight 3-hour samples (starting at midnight, PDT) every third day and one additional 24-hour sampler every sixth day during monitoring period (July-September).
B. Eight 3-hour samples (starting at midnight, PDT) every day during the monitoring period (July-Sept and one additional 24-hour sample every sixth day year-round.
C. Eight 3-hour samples on the 5 peak ozone days plus each previous day, eight 3-hour samples every sixth day, and one additional 24-hour sample every sixth day during monitoring period.
D. Eight 3-hour samples (starting at midnight, PDT) every day during the monitoring period (July-September).
E. Four 3-hour samples (3-6am, 6-9am, 1-4pm, 5-8pm, PDT) every third day during monitoring period (probably July-September), and four samples (6-9am, 9-noon, 1-4pm, 5- 8pm, PDT) per day on two consecutive days for five episodes during peak ozone season.
F. Continuous NMHC analyzer (e.g., Bendix 8202 or automated Preconcentration Direct injection Flame Ionization Detection gas chromatography, PDFID).

identified and added to this network, and Appendix B should be modified and verified accordingly. The existing network of surface measurements is adequate to determine some surface transport patterns, but it is not sufficient to determine winds aloft or some mesometeorological phenomena.

1.6.2 Supplemental Air Quality and Meteorological Measurements

The existing surface air quality and meteorological monitoring network will be supplemented by additional measurements made specifically during the SCOS97-NARSTO study period. Table 1-2 provides a summary of the supplemental surface air quality and meteorological measurements that will be made by contractors and by in-kind support from the U.S. Environmental Protection Agency. Table 1-2 also indicates planned systems and performance audits.

The majority of the supplemental surface air quality measurements are in connection with collection of volatile organic compounds (VOC) samples and continuous measurements of ozone, nitric oxide (NO), nitrogen dioxide (NO_2), oxides of nitrogen (NO_X), total oxidized nitrogen (NO_y), and peroxyacetylnitrate (PAN), especially in critical areas of the study domain (e.g., transport corridors) where these measurements are not currently being made. Accurate quantification of NO and NO_2 is important because the inter-conversion of NO and NO_2 is the photochemical mechanism for the formation and destruction of ozone in the troposphere. Organic nitrates such as PAN provide a means to transport NO_X from source regions to downwind locations. Total oxidized nitrogen (NO_y) provides an estimate of the total nitrogen budget and photochemical aging of the air mass. As described in the previous section, current PAMS networks in southern California do not measure hydrocarbons and carbonyl compounds on a daily basis, with the exception of the Pico Rivera Type 2 site in the SoCAB. Supplemental measurements are required for the SCOS97 study during multi-day intensives in order to obtain VOC measurements throughout the IOP. VCAPCD and SDAPCD will supplement their existing sampling schedules to include all SCOS97 IOP days. Because of their larger network, the SCAQMD will not be able to supplement their existing sampling schedule. The supplemental measurements for SCOS97-NARSTO include additional PAMS VOC measurements in the SoCAB. In addition, the extreme downwind PAMS site in SoCAB is scheduled for deployment in 1998, one year after the SCOS97 study. Lancaster has been tentatively selected for this site. The MDAPCD is considering VOC measurements in the Lancanster during SCOS97 to document transport of VOC through Soledad Canyon at Hesperia to document transport of VOC through Cajon Pass. The two “tracers of opportunity”, perchloroethylene and methylchloroform will be measured semi-continuously near the Barstow area.

The supplemental surface air quality measurements also include specialized measurements by several investigators. These measurements include radiocarbon, semi-continuous hydrocarbons, biogenic organic compounds, multifunctional carbonyl compounds, total reactive carbon and polycyclic aromatic hydrocarbons. Other than the automated gas chromagraphic hydrocarbon analysis by EPA, no system or performance audits are planned for these special measurements. In most cases, air quality data from the SCOS97 core measurements will allow for data validation checks by individual investigators.

Table 1-2
SCOS97-NARSTO Supplemental Surface Air Quality Measurements

Rec. #	Institution	Investigator	Species	Units	Measurement Device	Site Location	Air Basin
1	CE-CERT	Fitz, Dennis	HNO3 & Ammonia	ppbV	Double Diffusion Denuder	Azusa	SoCAB
2	CE-CERT	Fitz, Dennis	HNO3 & Ammonia	ppbV	Double Diffusion Denuder	Riverside	SoCAB
3	CE-CERT	Fitz, Dennis	HNO3, NO2	ppbV	TDLAS	Azusa	SoCAB
4	CE-CERT	Fitz, Dennis	NOy, NO & Ozone	ppbV	TECO 42CY & Dasibi	San Nicolas Island	SoCAB
5	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42CY & TECO 42/14	Azusa	SoCAB
6	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42CY & TECO 42/14	Burbank	SoCAB
7	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42CY & TECO 42	Banning	SoCAB
8	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42CY & TECO 42	Simi Valley	SCCAB
9	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42CY & TECO 42	Alpine	SDAB
10	CE-CERT	Fitz, Dennis	NOy, NO, NO2, HNO3	ppbV	TECO 42 + Moly Converter	Riverside	SoCAB
11	CE-CERT	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	San Clemente	SoCAB
12	CE-CERT	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	Azusa	SoCAB
13	CE-CERT	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	LA North Main	SoCAB
14	CE-CERT	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	Burbank??	SoCAB
15	DGA	Grosjean, Daniel	PAN, PPN, PERC, Meth Chlor	ppbV	Gas Chromotagraphy-ECD	Azusa	SoCAB
16	DGA	Grosjean, Daniel	PAN, PPN, PERC, Meth Chlor	ppbV	Gas Chromotagraphy-ECD	Simi Valley	SCCAB
17	DRI	Zielinska, Barbara	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	Tijuana	Mexico
18	DRI	Zielinska, Barbara	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	Cans & DNPH cartridge	Mexicali	Mexico
19	EPA	Lewis	radiocarbon	ppbC	canisters	San Gabriel Mt Peaks	SoCAB
20	EPA	McClenny/Lewis	VOCs/radiocarbon	ppbC	Continuous GC	Azusa	SoCAB
21	PSU?	O'Brien, Bob	HO, HO2, RO2	ppbV	Laser Fluorescence	Azusa (Pico Rivera?)	SoCAB
22	UC Riverside	Arey, Janet	Isoprene, Terpenes, MVK?	ppbC (ppbV)	canisters & FID	Ojai	SCCAB
23	UC Riverside	Arey, Janet	Isoprene, Terpenes, MVK?	ppbC (ppbV)	canisters & FID	San Gabriel Mt Peaks	SoCAB
24	UC Riverside	Arey, Janet	MVK?, oxydation biogenic HC	ppbC (ppbV)	canisters & FID	El Monte	SoCAB
25	Aervironment	Pankratz, David	ozone & WS, WD, T, RH	ppbV m/s mb & C	Dasibi & Std Met	Santa Catalina-Airport	SoCAB
26	Aervironment	Pankratz, David	ozone & WS, WD, T, RH	ppbV m/s mb & C	Dasibi & Std Met	Calabasas	SoCAB
27	Aervironment	Pankratz, David	ozone & WS, WD, T, RH	ppbV m/s mb & C	Dasibi & Std Met	Palos Verdes	SoCAB
28	Aervironment	Pankratz, David	ozone NOy & WS, WD, T, RH	ppbV m/s mb & C	TECO 42 CY Dasibi & Std Met	Santa Catalina-Elevated	SoCAB
29	Aervironment	Pankratz, David	ozone NOy & WS, WD, T, RH	ppbV m/s mb & C	TECO 42 CY Dasibi & Std Met	El Cajon Pass	SoCAB
30	CE-CERT	Fitz, Dennis	ozone & met	ppbV m/s mb & C	Dasibi & Std Met	Tehachepi Pass	MDAB
31	UCD	Charles, Judy	Multifunctional Carbonyls	ppbV	PFBHA/Ion trap MS	Azusa??	SoCAB
32	UCLA	Paulson, Suzanne	Total reactive carbon	ppbC	cold trap & FID	Four sites along trajectory	SoCAB
33	UCR	Arey, Janet	PAH	ppbC	Hi-vol and PUF plugs	LA N. Main/Azusa/Riverside?	SoCAB

Table 1-2 Continued
SCOS97-NARSTO Supplemental Surface Air Quality Measurements

	Period		Averaging	Operational Checks		Calibration		Audit	
Rec. #	Starting	Ending	Time	By	Period	By	Period	Performance	System
1	IOP	IOP	Hourly	CE-CERT	Daily	CE-CERT	Daily	-	-
2	IOP	IOP	Hourly	CE-CERT	Daily	CE-CERT	Daily	-	-
3	IOP	IOP	Hourly	CE-CERT	Daily	CE-CERT	Daily	-	-
4	15-Jun-97	15-Oct-97	Hourly	CE-CERT	-	CE-CERT	Weekly	-	-
5	15-Jun-97	15-Oct-97	Hourly	SCAQMD	Daily	CE-CERT	Weekly	-	-
6	15-Jun-97	15-Oct-97	Hourly	SCAQMD	Daily	CE-CERT	Weekly	-	-
7	15-Jun-97	15-Oct-97	Hourly	SCAQMD	Daily	CE-CERT	Weekly	-	-
8	15-Jun-97	15-Oct-97	Hourly	VCAPCD	Daily	CE-CERT	Weekly	-	-
9	15-Jun-97	15-Oct-97	Hourly	SDCAPCD	Daily	CE-CERT	Weekly	-	-
10	15-Jun-97	15-Oct-97	Hourly	SCAQMD	Daily	CE-CERT	Weekly	-	-
11	IOP	IOP	8 hrs ??	CE-CERT	--	CE-CERT	IOP	DRI	DRI
12	IOP	IOP	3 hrs	CE-CERT	--	CE-CERT	IOP	DRI	DRI
13	IOP	IOP	3 hrs	CE-CERT	--	CE-CERT	IOP	DRI	DRI
14	IOP	IOP	3 hrs	CE-CERT	--	CE-CERT	IOP	DRI	DRI
15	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	-	-
16	15-Jun-97	15-Oct-97	Hourly	DGA	Daily	DGA	Daily	-	-
17	IOP	IOP	3 hrs	Tracer ES&T	--	DRI	IOP	DRI	DRI
18	IOP	IOP	3 hrs	Tracer ES&T	--	DRI	IOP	DRI	DRI
19	1-Sep-97	1-Oct-97	hourly	EPA	Measurement	EPA	Measurement	-	-
20	1-Sep-97	1-Oct-97	hourly	EPA	Daily	EPA	Daily	DRI	DRI
21	IOP	IOP	Continuous	PSU	Daily	PSU	Daily	?	?
22	IOP	IOP	Species Dep	UCR	Measurement	UCR	Measurement	-	-
23	IOP	IOP	Species Dep	UCR	Measurement	UCR	Measurement	-	-
24	IOP	IOP	Species Dep	UCR	Measurement	UCR	Measurement	-	-
25	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	ARB-MLD	ARB-MLD
26	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	ARB-MLD	ARB-MLD
27	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	ARB-MLD	ARB-MLD
28	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	MLD (no NOy)	MLD (no NOy)
29	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	MLD (no NOy)	MLD (no NOy)
30	15-Jun-97	15-Oct-97	Hourly	CE-CERT	Daily	CE-CERT	Daily	-	-
31	IOP	IOP	3 hrs	UCD	IOP	UCD	IOP	-	-
32	4 -1 week	1-Sep-97	hourly	UCLA	daily	UCLA	daily	-	-
33	IOP	IOP	12 hrs	UCR	IOP	UCR	IOP	-	-

1.6.3 Aloft Meteorological Measurements

To obtain information on temperature, relative humidity, and wind at various levels of the atmosphere above ground level, meteorological soundings will be used. Routine, twice-per-day radiosondes will provide in situ measurements of pressure, temperature, humidity, and wind speed and direction at various altitudes above ground. Two types of remote sounding, radar wind profilers and Doppler acoustic sounders, will provide continuous measurements of upper-air winds during the entire four-month SCOS97-NARSTO measurement period. Table 1-3 provides a summary of the aloft meteorological measurements that are currently being made by local agencies and that will be made by contractor. Table 1-3 also indicates planned systems and performance audits.

Radar Wind Profilers (RWP) provide sequential horizontal and vertical wind components in data assimilation and model comparison on a sub-hour time scale. RWPs generally acquire measurements within 100 to 150 m thick layers between ~0.150 and 3 km AGL with a minimum vertical resolution of 60 meters. A radio-acoustic sounding system (RASS) can be used to quantify virtual temperature to elevations of ~1 km AGL (up to 2 km AGL in ideal conditions), but this is insufficient altitude to characterize the daytime mixed layers of 2–3 km AGL often observed in much of the study area. There are currently five radar wind profilers operating in southern California, with a sixth expected near Escondido by 1997. Three of the profilers are required by the PAMS program. The Ventura County APCD operates one at Simi Valley, the South Coast Air Quality Management District operates one at Los Angeles International Airport, and the San Diego APCD operates one at Pt. Loma in San Diego. The other two are located at Ontario Airport and Vandenberg Air Force Base. The ARB has two profilers available to SCOS97 that will be sited within the SoCAB as needed, e.g., at Norton AFB and at the ARB facility in El Monte during 1996. RASS is used with each of the agency radar wind profilers to obtain a vertical profile of virtual temperature. Additional RWPs and sodars will be operated continuously during the SCOS97-NARSTO study by NOAA and Radian as shown in Table 1-3.

Acoustic Sounders (Sodars), like RWPs, also acquire continuous measurements of winds aloft. Sodars have better vertical resolution (~30 m layers from ~50 to 600 m AGL) but less vertical range (750 m AGL maximum). Sodars are most applicable in locations with lower-level structure, such as that found in marine layers, in channeling through canyons and passes, and in nighttime radiation inversions.

Radiosonde measurements provide characterization of the entire atmospheric boundary layer and portions of the upper atmosphere up to 10 mb (30 km ASL). These measurements provide information on winds, temperature, and humidity. In addition to the NWS twice-per-day (0 and 12 Z) radiosonde releases at San Diego (within the modeling domain) and at Desert Rock, Nevada (on the east side of the northern border of the modeling domain), several military organizations in southern California release radiosondes, including the Naval Air Warfare Center (NAWC) which also takes regular ozonesonde data at Point Mugu (and occasionally at other selected sites in Ventura County). The frequency of radiosonde NAWC releases at San Nicolas Island and Pt. Mugu will be increased from twice-per-day to four times per day during IOPs as part of SCOS97. Radiosonde launches are also made periodically at Vandenberg AFB, Edwards AFB, Miramar NAS, and China Lake NAS, but these facilities launch on their own schedules. Also, the SCOS97 effort will provide radiosonde packages to two other military installations

Table 1-3
SCOS97-NARSTO Aloft Meteorological and Radiation Measurements

Rec. #	Institution	Investigator	Species	Units	Measurement Range	Device	Site Location	Air Basin
1	ARB	Smith, Reginald	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	El Monte Airport	SoCAB
2	ARB	Smith, Reginald	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Norton AFB	SoCAB
3	CE-CERT	Fitz, Dennis	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde-US Navy Base	USC-Hancock Fnd Bldg	SoCAB
4	CE-CERT	Fitz, Dennis	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde-US Navy Base	UCLA	SoCAB
5	CE-CERT	Fitz, Dennis	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde-US Navy Base	Cal State Northridge	SoCAB
6	NOAA	Neff, Bill	WS, WD	m/s	Srfc to 600m/75 m	mono Sodar	Oxnard Plain	SCCAB
7	NOAA	Neff, Bill	WS, WD	m/s	Srfc to 600m/75 m	Sodar	Santa Clarita Valley	SCCAB
8	NOAA	Neff, Bill	WS, WD	m/s	Srfc to 600m/75 m	Sodar	San Gabriel Mtn	SoCAB
9	NOAA	Neff, Bill	WS, WD	m/s	Srfc to 600m/75 m	Sodar	Banning	SoCAB
10	NOAA	Neff, Bill	WS, WD	m/s	Srfc to 600m/75 m	mono Sodar	Oceanside	SDAB
11	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Goleta	SCCAB
12	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Oxnard Plain	SCCAB
13	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	USC-Hancock Fnd Bldg	SoCAB
14	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Palmdale	SoCAB
15	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	San Clemente Island	SoCAB
16	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Santa Catalina	SoCAB
17	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Cal State Northridge	SoCAB
18	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Tustin	SoCAB
19	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Los Alamitos	SoCAB
20	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Alpine	SDAB
21	NOAA	Neff, Bill	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Oceanside	SDAB
22	NOAA	M.J. Post	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Brown Field	SDAB
23	NOAA	M.J. Post	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Calexico	Salton SAB
24	NWS	Helvy, Roger	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Miramar Nav Air St	SDAB
25	Radian-STI	Frederick, George	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Barstow	MDAB
26	Radian-STI	Frederick, George	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Victorville/George AFB	MDAB
27	Radian-STI	Frederick, George	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	March AFB/Riverside	SoCAB
28	Radian-STI	Frederick, George	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Thermal Airport	Salton SAB
29	Radian-STI	Frederick, George	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Temecula	SoCAB
30	SCAQMD	Durkee, Kevin	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Los Angeles Airport	SoCAB
31	SCAQMD	Durkee, Kevin	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Ontario Airport	SoCAB
32	SDCAPCD	Bigler-Engler, Virginia	WS, WD	m/s	Srfc to 600m/75 m	Sodar	Valley Center-Escondido	SDAB
33	SDCPACD	Bigler-Engler, Virginia	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Valley Center-Escondido	SDAB
34	SDCPACD	Bigler-Engler, Virginia	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Point Loma	SDAB
35	US Marines	Helgeson, Norm	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	29 Palms	MDAB
36	US Navy	Helvy, Roger	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Point Mugu	SCCAB
37	US Navy	Helvy, Roger	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	San Nicolas Island	SoCAB
38	US Navy	Helvy, Roger	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Tustin	SoCAB
39	US Navy	Helvy, Roger	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Naval Air St-North Island	SDAB
40	USAF	Crosiar, Chris	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Vandenberg AFB	SCCAB
41	USAF	Harvey, Phil	WS, WD, RH, Pres, T	m/s mb & C	Srfc to 5 Km/100m	Rawinsonde	Edwards AFB	MDAB
42	USAF	Crosiar, Chris	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS (915 & 449 MHz)	Vandenberg AFB	SCCAB
43	VCAPCD	Field, Kent	WS, WD, T	m/s & C	Srfc to 2 Km/100m	RWP-RASS	Simi Valley	SCCAB
44	CE-CERT	Carter, W	Broadband & UV rad data	-	-	Brewer Radiometers	Azusa	SoCAB
45	CE-CERT	Carter, W	Broadband & UV rad data	-	-	Brewer Radiometers	Riverside	SoCAB
46	CE-CERT	Carter, W	Broadband & UV rad data	-	-	Brewer Radiometers	Table Mtn/Mt. Wilson	SoCAB

Table 1-3 Continued
SCOS97-NARSTO Meteorological and Radiation Measurements

	Period		Averaging	Operational Checks		Calibration		Audit	
Rec. #	Starting	Ending	Time	By	Period	By	Period	Performance	System
1	1-Apr-97	15-Oct-97	Hourly	ARB	Daily	ARB	Daily	AV - Barnett	AV - Barnett
2	1-Apr-97	15-Oct-97	Hourly	ARB	Daily	ARB	Daily	-	-
3	IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	RWP-RASS	-
4	IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
5	IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
6	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
7	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
8	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	AV - Barnett	AV - Barnett
9	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
10	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	AV - Barnett	AV - Barnett
11	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
12	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	AV - Barnett	AV - Barnett
13	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	Rawinsondes	-
14	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
15	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
16	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
17	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
18	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
19	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	Rawinsondes	-
20	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
21	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	Rawinsondes	-
22	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
23	15-Jun-97	15-Oct-97	Hourly	NOAA	Daily	NOAA	Daily	-	-
24	IOP	IOP	seconds	NWS	launch	NWS	launch	-	-
25	15-Jun-97	15-Oct-97	Hourly	Radian-STI	Daily	NOAA	Daily	-	-
26	15-Jun-97	15-Oct-97	Hourly	Radian-STI	Daily	NOAA	Daily	-	-
27	15-Jun-97	15-Oct-97	Hourly	Radian-STI	Daily	NOAA	Daily	-	-
28	15-Jun-97	15-Oct-97	Hourly	Radian-STI	Daily	NOAA	Daily	-	-
29	15-Jun-97	15-Oct-97	Hourly	Radian-STI	Daily	NOAA	Daily	-	-
30	Permanent		Hourly	SCAQMD	Daily	SCAQMD	Daily	AV - Barnett	AV - Barnett
31	Permanent		Hourly	SCAQMD	Daily	SCAQMD	Daily	AV - Barnett	AV - Barnett
32	15-Jun-97	15-Oct-97	Hourly	SDCAPCD	Daily	SDCAPCD	Daily	SDCAPCD	SDCAPCD
33	Permanent		Hourly	SDCAPCD	Daily	SDCAPCD	Daily	SDCAPCD	SDCAPCD
34	Permanent		Hourly	SDCAPCD	Daily	SDCAPCD	Daily	SDCAPCD	SDCAPCD
35	IOP	IOP	seconds	Marines	launch	Marines	launch	-	-
36	IOP	IOP	seconds	US Navy	launch	US Navy	launch	-	-
37	IOP	IOP	seconds	US Navy	launch	US Navy	launch	-	-
38	IOP	IOP	seconds	US Navy	launch	US Navy	launch	RWP-RASS	-
39	IOP	IOP	seconds	US Navy	launch	US Navy	launch	-	-
40	IOP	IOP	seconds	USAF	launch	USAF	launch	RWP-RASS	-
41	IOP	IOP	seconds	USAF	launch	USAF	launch	-	-
42	Permanent		Hourly	USAF	Daily	USAF	Daily	Rawin	-
43	Permanent		Hourly	VCAPCD	Daily	VCAPCD	Daily	AV - Barnett	AV - Barnett
44	IOP-Rad	IOP	-	CE-CERT	-	CE-CERT	-	-	-
45	IOP-Rad	IOP	-	CE-CERT	-	CE-CERT	-	-	-
46	IOP-Rad	IOP	-	CE-CERT	-	CE-CERT	-	-	-

which can arrange to schedule twice-per-day (0 and 12 Z) radiosonde releases during IOPs in addition to their own launches. Of the four military installations, Vandenberg and Edwards AFB are the most likely candidates. Four additional radiosonde sites, with four releases per day during IOPs, will be provided as part of the SCOS97 effort.

1.6.4 Aloft Air Quality Measurements

Aloft air quality measurements will be made during IOPs using instrumented aircraft and ground-based lidar and ozonesondes. These measurements will be used to measure the three dimensional distribution of ozone, ozone precursors, and meteorological variables. The aircraft will provide information at the boundaries and will document the vertical gradients, the mixed layer depth, and nature of elevated pollutant layers. The concentrations and (in conjunction with upper air wind soundings) the transport of pollutants across selected vertical planes will be measured to document transport of pollutants and precursors between offshore and onshore and between air basins. Redundancy and operational cross-checks can be built into the aircraft measurements by including overlapping flight plans for the various types of aircraft and by doing aircraft measurements near the ground over air quality monitoring sites. Table 1-4 provides a summary of the aloft air quality measurements that will be made by contractors. Table 1-4 also indicates planned systems and performance audits.

Four aircraft are included in the core program. Two small air quality aircraft will be used to document the vertical and horizontal gradients of ozone, NO_X, ROG, temperature, and humidity in the study region. One aircraft will be used to document the horizontal and vertical gradient along the northern and eastern boundary of the study domain. A larger multi-engine aircraft will be used to document the horizontal and vertical gradients offshore and across the shoreline. The specific flight plans are being developed for these aircrafts under different meteorological scenarios by the SCOS97 Modeling Working Group.

The NOAA ground-based lidar will be used to characterize the vertical ozone structure within the SoCAB. This lidar could be located at El Monte within the San Gabriel Valley to examine the bifurcation of flow from Los Angeles to the San Fernando and San Gabriel Valleys. Ozonesondes will be released at the ground-based lidar sites for quality assurance purposes and to obtain a higher vertical range of ozone distributions. Four ozonesondes will be released at six different sites each day of an IOP. Collocation with the ozone lidars dictates that two of the six ozonesonde sites would be at El Monte and Ontario. El Monte has surface ozone but Ontario does not. However, Upland has a surface ozone monitor and is not too distant from Ontario. Four other recommended locations are at Van Nuys Airport to characterize San Fernando Valley vertical ozone structure for possible transport to Ventura, Anaheim in the south basin for possible transport from the south coastal plain of the SoCAB to San Diego, and Temecula for inland transport to San Diego. Central Los Angeles is also desirable to characterize the central SoCAB, but logistics in the downtown area may be a complicating factor. Data will also be available from the existing NAWC ozonesonde release site at Pt. Mugu.

1.7 Guide to Quality Assurance Plan

This introductory section has specified the goals and technical objectives of SCOS97-NARSTO, and planned measurements. Section 2 presents a summary of quality assurance task

Table 1-4
SCOS97-NARSTO Aloft Air Quality Measurements

Rec. #	Institution	Investigator	Species	Units	Range	Device	Location	Air Basin
1	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	Cal State Northridge	SoCAB
2	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	USC-Hancock Fnd Bldg	SoCAB
3	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	Anaheim	SoCAB
4	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	North San Diego County	SDAB
5	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	Riverside	SoCAB
6	CE-CERT	Fitz, Dennis	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde - KI	Upland	SoCAB
7	CE-CERT/STI	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	-	Cans & DNPH cartridge	Northern Boundary	Various
8	CE-CERT/UCD	Fitz, Dennis	VOCs, CH4 (CO, CO2, Carbonyls)	ppbC (ppbV)	-	Cans & DNPH cartridge	In SoCAB	SoCAB
9	NOAA	Zhao, Yan	ozone	ppbV	Srfc to 1 Km/100m	Lidar	El Monte Airport	SoCAB
10	US Navy	Helvy, Roger	ozone	ppbV	Srfc to 5 Km/100m	Ozonesonde	Point Mugu	SCCAB
11	US Navy	Helvy, Roger	ozone & met	ppbV m/s mb & C	Srfc to 1 Km/100m	Dasibi & Std Met	Point Mugu	SCCAB
12	EOPACE	Jensen, Doug	ozone, NO, NOy, met	ppbV m/s mb & C	Srfc to 1 Km/100m	Dasibi, TECO 42 CY, std Met	Montgomery Field	SDAB
13	SDCAPCD	Bigler-Engler, Virginia	ozone, NO, NO2, met	ppbV m/s mb & C	Srfc to 1 Km/100m	Dasibi, Monitor, std Met	Montgomery Field	SDAB
14	STI	Blumenthal, Don	ozone, NO, NOy, met	ppbV m/s mb & C	Srfc to 1 Km/100m	Dasibi, TECO 42 CY, std Met	Camarillo Airport	SCCAB
15	UC Davis	Carroll, John	ozone, NO, NOy, met	ppbV m/s mb & C	Srfc to 1 Km/100m	Dasibi, TECO 42 CY, std Met	El Monte Airport	SoCAB

Table 1-4 Continued
SCOS97-NARSTO Aloft Air Quality Measurements

		Period		Averaging	Operational Checks		Calibration		Audit	
Rec. #	**Flight Plan**	**Starting**	**Ending**	**Time**	**By**	**Period**	**By**	**Period**	**Performance**	**System**
1		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
2		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
3		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
4		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
5		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
6		IOP	IOP	seconds	CE-CERT	launch	CE-CERT	launch	-	-
7	Various	IOP	IOP	Minutes	CE-CERT	--	CE-CERT	IOP	DRI	DRI
8	Various	IOP	IOP	Minutes	CE-CERT	--	CE-CERT	IOP	DRI	DRI
9		IOP	IOP	seconds	NOAA	Daily	NOAA	Daily	Airplane-UCD	-
10		IOP	IOP	seconds	US Navy	launch	US Navy	launch	-	-
11	* 2 flights/day-north 1/2 southern boundary	15-Jun-97	15-Oct-97	Hourly	U.S. Navy	Flight	U.S. Navy	Flight	-	-
12	* 2 flights/day - saw tooth/southern boundary	IOP	IOP	seconds	EOPACE	Flight	EOPACE	Flight	Airplane-UCD	ARB-MLD
13	* transport SoCAB-SDAB-Eastern Boundary	IOP	IOP	seconds	SDCAPCD	Flight	SDCAPCD	Flight	Airplane-UCD	ARB-MLD
14	* 2 flights/day - saw tooth/northern boundary	IOP	IOP	seconds	STI	Flight	STI	Flight	Airplane-UCD	ARB-MLD
15	* 3 - 4 flights/day - 3 spirals/flight San Gabriel	IOP	IOP	seconds	UC Davis	Flight	UC Davis	Flight	MLD-Lidar	ARB-MLD

and activities for SCOS97, and project organization and responsibilities. Section 3 specifies the data quality objectives for SCOS97 measurements. Detailed quality assurance plans for surface air quality and meteorology, upper-air air quality, upper-air meteorology, and volatile organic compound measurements are provided in Sections, 4,5,6 and 7, respectively.